

# PATENT ABSTRACTS OF JAPAN

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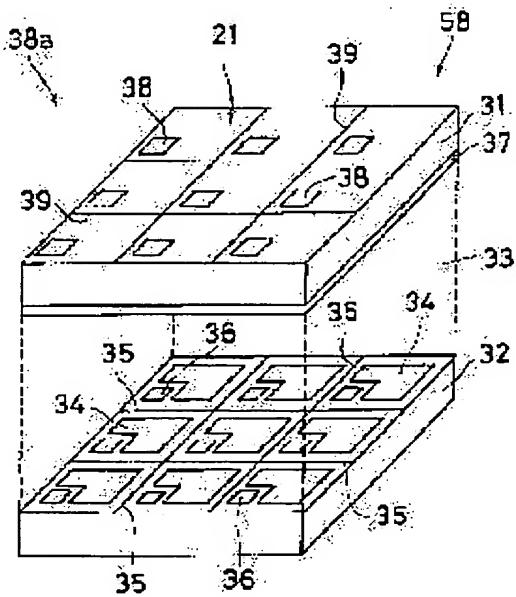
## (54) DISPLAY PANEL AND DISPLAY DEVICE

### (57)Abstract:

PROBLEM TO BE SOLVED: To provide a display panel with a compact constitution by which reading of a picture and highly precise display can be attained.

SOLUTION: The strength of a light transmitted through a glass substrate 32, a liquid crystal layer 33, and a glass substrate 31 in this order is made different for each pixel area by changing the transmissivity of the liquid crystal layer 33 for each pixel area. Thus, a light with different strength for each pixel area is emitted outside from the surface of the glass substrate 31 opposite to the liquid crystal layer 33 so that the display of a picture or the like can be realized. Plural light receiving elements 38 are arrayed on the surface of the glass substrate 31 being a display face so that a light irradiated from outside opposite to the liquid crystal layer 33 of the glass substrate 31 can be received. A picture can be read by receiving a light from the picture on a display face.

Opaque light receiving element 38 are arranged in the shadow of opaque switching elements 36 so that a shielding area can be minimized.



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**CLAIMS**

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[Claim(s)]

[Claim 1]The 1st substrate and the 2nd substrate characterized by comprising the following which countered mutually and have been arranged, A display panel which displays by a thing which were provided with the 1st substrate and a liquid crystal layer which filled up a wooden floor with a liquid crystal and was formed in it the 2nd set, and arranged to matrix form, and for which transmissivity of light of a liquid crystal layer is changed for two or more picture element regions of every.

A signal wire wired between picture element regions on the surface of the 1st substrate that attends the 2nd substrate.

A picture element electrode formed in each picture element region, respectively.

A switching element which is formed in each picture element region, respectively, and controls a flow with a signal wire and a picture element electrode.

A single flat electrode formed in an entire surface of the 2nd substrate which attends the 1st substrate.

This photo detector that are two or more photo detectors arranged by matrix form on a liquid crystal layer of the 2nd substrate, and the surface of an opposite hand, and has been arranged at a position which is in agreement with shade of a switching element,

respectively.

[Claim 2]A display panel comprising:

The 1st substrate and the 2nd substrate which countered mutually and have been arranged.

The 1st substrate and an EL luminescence layer pinched and formed in a wooden floor the 2nd set.

The 1st insulating layer that intervenes between the 1st substrate and an EL luminescence layer.

In a display panel which displays by a thing which were provided with the 2nd insulating layer that intervenes between the 2nd substrate and an EL luminescence layer, and arranged to matrix form, and for which prescribed voltage is impressed to an EL luminescence layer for two or more picture element regions of every, Two or more photo detectors arranged by matrix form on an EL luminescence layer of said 2nd substrate, and the surface of an opposite hand.

[Claim 3]A display comprising:

A display panel which displays by controlling light to which two or more display pixel and two or more photo detectors are arranged and constituted by matrix form, and are emitted for every display pixel.

A light-receiving driving means which scans said each photo detector and carries out selection driving one by one.

A display driving means which scans said each display pixel and carries out selection driving one by one.

A reading control means controlled to perform a light-receiving drive while performing display driving to which light is made to emit from all the display pixels, in order to read a picture of a manuscript, An image storing means which memorizes image data from a photo detector, and an input member of a pen type which inputs by intercepting outdoor daylight to a photo detector, A data rewriting means for rewriting data which is equivalent to an input coordinate among image data memorized by an input coordinate detection means to detect a position of a photo detector which had outdoor daylight intercepted as an input coordinate, and image storing means.

[Claim 4]The display according to claim 3 provided with a printer section for printing and outputting image data which was provided in said display panel at one, and was

memorized by image storing means.

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## DETAILED DESCRIPTION

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[Detailed Description of the Invention]

[0001]

[Field of the Invention] This invention relates to the display panel and display for displaying the read picture information while reading two-dimensional picture information.

[0002]

[Description of the Prior Art] Generally as a display of a picture, a CRT (Cathod Ray Tube) display, a liquid crystal display, EL (Electroluminescent) display, etc. are known. These displays are having the input device formed in one, or connected to another input device by a cable, and are enabling the input of the image data for displaying.

[0003] From the display surface of the liquid crystal display panel which displays a picture, there are a device etc. which are indicated to JP,7-152010,A and JP,8-137617,A as a device which performs a pen input. Both arrange the tablet which uses an electrostatic film etc. on the display surface of a liquid crystal display panel, and the input from a display surface is enabled.

[0004] There is a device indicated to JP,2-54591,B from the display surface of the display panel of a light emitting diode as a device which performs a pen input. This is the device which arranged the cell which made the pair the light emitting diode and the light-receiving transistor to matrix form, and constituted the display panel. Furthermore, the pen which has a light-emitting part is used at a tip, and the light-receiving transistor arranged by the display surface with the light emitting diode detects the light from a nib. Thus, the input to a device is performed because a light-receiving transistor detects light.

[0005] JP,8-51521,A is provided with the system which connected the host computer and printer which have a scanner and a display panel. In this system, a picture is read from a scanner, the read picture is displayed on a display panel, the read image data is processed by computer, and the processed picture is printed with the printer.

[0006]

[Problem(s) to be Solved by the Invention] In JP,7-152010,A, JP,8-137617,A, and JP,2-54591,B, an operator has to perform a handwritten input using an input pen, in the

picture drawn on the manuscript, the input which can be reproduced faithfully is impossible and input operation also requires time and effort.

[0007]In the display panel indicated to JP,2-54591,B, the light emitting diode is used, and since it drives, comparatively big electric power is needed. Since each pixel is constituted by the single light emitting diode, the size of 1 pixel is comparatively large and the display accuracy of a picture is insufficient.

[0008]Since the system indicated to JP,8-51521,A connects a scanner, a computer, and a printer by a cable and is constituted, a system becomes large-scale and is inconvenient to carry especially.

[0009]The purpose of this invention is to provide the display panel in which a display possible [ reading of a picture ] and high definition is possible with compact composition. reading and a display of a picture are possible for other purposes of this invention, they can perform edit of a display image if needed, and can print a display image further -- small -- carrying -- it is providing a convenient display.

[0010]

[Means for Solving the Problem]The 1st substrate and the 2nd substrate whose this invention is characterized by that a display panel comprises the following and which countered mutually and have been arranged, A display panel which displays by a thing which were provided with the 1st substrate and a liquid crystal layer which filled up a wooden floor with a liquid crystal and was formed in it the 2nd set, and arranged to matrix form, and for which transmissivity of light of a liquid crystal layer is changed for two or more picture element regions of every.

A signal wire wired between picture element regions on the surface of the 1st substrate that attends the 2nd substrate.

A picture element electrode formed in each picture element region, respectively.

A switching element which is formed in each picture element region, respectively, and controls a flow with a signal wire and a picture element electrode.

This photo detector that are a single flat electrode formed in an entire surface of the 2nd substrate which attends the 1st substrate, and two or more photo detectors arranged by matrix form on a liquid crystal layer of the 2nd substrate, and the surface of an opposite hand, and has been arranged at a position which is in agreement with shade of a switching element, respectively.

[0011]If this invention is followed, luminous intensities which penetrate the 1st substrate, a liquid crystal layer, and the 2nd substrate in this order by changing transmissivity of a liquid crystal layer for every picture element region differ for every

picture element region. Thus, a display of a picture etc. is realized by light from which intensity differs for every picture element region being emitted to the exterior from the surface of the 2nd substrate of a liquid crystal layer and an opposite hand. In the surface of the 2nd substrate used as a display surface, two or more photo detectors are arranged and light irradiated from a liquid crystal layer of the 2nd substrate and the outside of an opposite hand is received.

[0012]Thus, since a manuscript in which a picture was drawn, for example since a photo detector was provided on a display surface can be pressed against a display surface, a picture can be read by receiving light from a picture by a display surface and common use of a display surface and the acceptance surface is moreover carried out, composition of a display panel is dramatically compact.

[0013]Since it is displaying using a liquid crystal, there is little power consumption compared with a display panel by a light emitting diode etc., a size which is 1 pixel can be made small, and a display of a picture is a high definition.

[0014]If this invention is followed, predetermined voltage will be impressed between flat electrodes in which a switching element counters a picture element electrode and this picture element electrode in a picture element region which made it flow through a signal wire and a picture element electrode, an orientation direction of a liquid crystal element will be changed, and transmissivity of light of a liquid crystal layer will change. On the other hand, in a picture element region where a switching element does not make it flow through a signal wire and a picture element region, voltage is not impressed to a liquid crystal layer and transmissivity of light does not change, either. Thus, by using a switching element, since only a display pixel to which transmissivity is changed makes it flow through a signal wire and a picture element electrode and does not make it flow except this, malfunction, a cross talk, etc. of a display are reduced and it can improve display contrast.

[0015]If this invention is furthermore followed, light irradiated among lights which penetrated the 1st substrate by picture element electrode in a picture element region will penetrate a picture element electrode, a liquid crystal layer, and the 2nd substrate, and will be emitted. Light irradiated by switching element in a picture element region is not emitted from a display panel, without being interrupted there and reaching even a liquid crystal layer. Although a photo detector also has non-translucency, since it is located in shade of a switching element, a shielding region is not increased further. Thus, since a shielding region of light can be held down to minimum by putting a switching element and a photo detector in order along a direction of movement of light, a high definition

display is possible.

[0016]A display panel this invention is characterized by that comprises the following.

The 1st substrate and the 2nd substrate which countered mutually and have been arranged.

The 1st substrate and an EL luminescence layer pinched and formed in a wooden floor the 2nd set.

The 1st insulating layer that intervenes between the 1st substrate and an EL luminescence layer.

In a display panel which displays by a thing which were provided with the 2nd insulating layer that intervenes between the 2nd substrate and an EL luminescence layer, and arranged to matrix form, and for which prescribed voltage is impressed to an EL luminescence layer for two or more picture element regions of every, Two or more photo detectors arranged by matrix form on an EL luminescence layer of said 2nd substrate, and the surface of an opposite hand.

[0017]If this invention is followed, from an EL luminescence layer, light from which intensity differs for every picture element region will be emitted by impressing prescribed voltage to an EL luminescence layer for every picture element region, and light from an EL luminescence layer will penetrate the 2nd insulating layer and the 2nd substrate in this order. A display of a picture etc. is realized by light from which intensity differs for every picture element region being emitted to the exterior from the surface of an EL luminescence layer and the 2nd substrate of an opposite hand. In the surface of the 2nd substrate used as a display surface, two or more photo detectors are arranged and light irradiated from an EL luminescence layer of the 2nd substrate and the outside of an opposite hand is received.

[0018]Thus, since a manuscript in which a picture was drawn, for example since a photo detector was provided on a display surface can be pressed against a display surface, a picture can be read by receiving light from a picture by a display surface and common use of a display surface and the acceptance surface is moreover carried out, composition of a display panel is dramatically compact.

[0019]Since it is displaying using EL, there is little power consumption compared with a display panel by a light emitting diode etc., a size which is 1 pixel can be made small, and a display of a picture is a high definition.

[0020]For example, two or more 1st electrode and two or more 2nd electrodes as shown below are added as new constituent features of a display panel to a display panel using above-mentioned EL. The 1st electrode is formed in the surface of the 1st substrate

which attends an EL luminescence layer, and constitutes the shape of a strip of paper prolonged in parallel with the direction of X. The 2nd electrode is formed in the surface of the 2nd substrate which attends an EL luminescence layer, and constitutes the shape of a strip of paper prolonged in parallel with the direction of Y which intersects perpendicularly in the direction of X.

[0021]If according to such composition it chooses the 1st electrode and the 2nd one electrode at a time and predetermined voltage is impressed among both, arbitrary picture element regions will be chosen and an EL luminescence layer of this picture element region will emit light. Thus, since an EL luminescence layer of desired arbitrary picture element regions can be made to emit light selectively, if there is a selection driving circuit which chooses an electrode and impresses voltage, it is not necessary to form a drive circuit which drives a picture element region separately for every picture element region, and composition can be simplified.

[0022]A display panel which displays because this invention controls light to which two or more display pixel and two or more photo detectors are arranged and constituted by matrix form, and are emitted for every display pixel, A light-receiving driving means which scans said each photo detector and carries out selection driving one by one, a display driving means which scans said each display pixel and carries out selection driving one by one, and a display which is characterized by comprising the following in order to read a picture of a manuscript.

A reading control means controlled to perform a light-receiving drive while performing display driving to which light is made to emit from all the display pixels.

An image storing means which memorizes image data from a photo detector.

An input member of a pen type which inputs by intercepting outdoor daylight to a photo detector.

A data rewriting means for rewriting data which is equivalent to an input coordinate among image data memorized by an input coordinate detection means to detect a position of a photo detector which had outdoor daylight intercepted as an input coordinate, and image storing means.

[0023]If this invention is followed, light used for a display will be used also for reading of a picture. Thus, since light can be shared to a display and reading of a picture, composition of a device can be simplified. Since it is controlled so that all display pixels emit light when reading a picture of a manuscript, it is the maximum light volume, and an equivalent light can be used for reading of a picture, and accuracy of reading can be improved.

[0024]If this invention is furthermore followed, by intercepting outdoor daylight to a photo detector, a position of this photo detector will be detected as an input coordinate, and data equivalent to this input coordinate will be rewritten. Thus, since image data is rewritten only by intercepting outdoor daylight, it can edit easily, an operator's handwritten input being possible and displaying a picture of a read manuscript. Since a photo detector provided in a display surface is shared for an input from a display surface in order to read a picture of a manuscript, a display, reading, and an input can be realized from a single display surface, and functions, such as an image editing, can be added with compact composition.

[0025]This invention is provided in said display panel at one, and is provided with a printer section for printing and outputting image data memorized by image storing means.

[0026]Since a printer section is provided in a display panel and one if this invention is followed, it is convenient to be also able to print a picture and to carry with a display.

[0027]

[Embodiment of the Invention]

(A 1st embodiment) Drawing 1 is a perspective view showing the display 11 which is a 1st embodiment of this invention, and drawing 2 is a sectional view showing the display 11. The display 11 is provided with the display panel 12, the printer section 13, and the input pen 14. The display panel 12 is provided with the back light unit 23 directly under the display surface 21, and arranges the manuscript detection sensor 22 on the edge part of the display surface 21. The display panel 12 is a panel which displays a picture on the display surface 21 by using the back light unit 23 as a light source. The back light unit 23 is provided with the cold cathode tube 101 and the reflecting member 102. The cold cathode tube 101 is arranged at the end of a display panel, and is covered with the reflecting member 102. The reflecting member 102 constitutes a curved surface and irradiates a display panel with the light from the cold cathode tube 101 uniformly. The manuscript detection sensor 22 is a sensor for detecting the manuscript mentioned later.

[0028]The display surface 21 is countered, it is joined to the display panel 12 in one, and the printer section 13 is provided with the photosensors 24a and 24b, two or more conveying roller pairs 25, and the thermal head 26. The conveyance hole 27 for conveying printing paper is formed in the printer section 13. It is provided near entrance 27a of the conveyance hole 27, the photosensor 24b is formed near exit 27b of the conveyance hole 27, and the photosensor 24a detects printing paper. The conveying roller pair 25 is a roller pair for putting and conveying printing paper, and is supported

pivots by the conveyance hole 27 side.

[0029]The input pen 14 is a member for comprising the material of non-translucency, accomplishing the shape where the tip sharpened, and performing an input from the display surface 21.

[0030]Drawing 3 is a perspective view showing the structure near [ display surface 21 ] the display panel 12, and drawing 4 is a top view showing the display surface 21. An interval is separated, the plate-like glass substrates 31 and 32 counter mutually, and are arranged, and the liquid crystal layer 33 which it filled up with the liquid crystal and was formed among these glass substrates 31 and 32 is arranged. Two or more picture element electrodes 34 are arranged and formed in matrix form, and the signal wire 35 is extended and formed in the surface by the side of the liquid crystal layer 33 of the glass substrate 32 in all directions in between these picture element electrodes 34. The picture element electrode 34 covers the field except one corner of a picture element region, and is formed, and the switching element 36 is formed in the field except the picture element electrode 34 in the picture element region, respectively. The switching element 36 is TFT (Thin Film Transistor; thin film transistor) etc. Three terminals of the switching element 36 are connected to the picture element electrode 34 and the signal wire 35 in every direction. The switching element 36 controls a flow with the signal wire 35 and the picture element electrode 34.

[0031]The flat electrode 37 is joined and formed in the surface of the glass substrate 31 which counters the glass substrate 32. In the surface of the flat electrode 37 and the glass substrate 31 of an opposite hand, the one photo detector 38 is formed at a time in the position corresponding to each switching element 36. The photo detector 38 is PD (PhotoDiode; photo-diode) etc. which comprise a-Si (amorphous silicon). The signal wire 39 is formed in the position corresponding to each signal wire 35. Thus, it is located in the shade of the switching element 36, the signal wire 35 is located in the shade of the signal wire 39, and the photo detector 38 can hold down a shielding region to minimum.

[0032]The display panel 12 comprises the photo detector (a 640x480-pixel display pixel and 640x480 pixels) 38, and drawing 3 shows the part. The display panel 12 is not restricted to a 640x480-pixel thing. All the display pixels constitute the LCD (Liquid Crystal Display) section 58, and all the photo detectors 38 assume that the area sensor 38a is constituted.

[0033]Drawing 5 is a circuit diagram showing an electric connection structure of the photo detector 38. The one photo detector 38 is also chosen at a time one by one by

choosing the one signal wire 39 of a line writing direction and a column direction at a time, respectively. Predetermined bias voltage is impressed to the selected photo detector 38. The signal wire 39 connected to the selected photo detector 38 flows with the amplifier 41 selectively with the switch 42. The switch 42 makes the amplifier 41 flow through the selected signal wire 39, and grounds the other signal wire 39. When the selected photo detector 38 detects light, the signal amplified from the amplifier 41 is outputted.

[0034]Drawing 6 is a block diagram showing the electric composition of the display 11. The display 11 is added to the composition shown in drawing 1, CPU (Central Prosessing.) It has Unit51, ROM(Read Only Memory) 52, RAM(Random Access Memory) 53, the image memory 54, the data line 55, the area sensor drive circuit 56, and LCD driving circuit 57.

[0035]According to directions of ROM52, the area sensor drive circuit 56, LCD driving circuit 57, and the printer section 13 are controlled, and CPU51 performs control which stores or reads image data to the image memory 54. The program for generalizing and controlling CPU51 is beforehand written in ROM52. RAM53 is a memory which evacuates temporarily the data calculated by CPU51. The image memory 54 is a memory for storing and saving the image data for one screen. The data line 55 is a signal wire for transmitting the image data which read to each block. The area sensor drive circuit 56 is a circuit for choosing each photo detector 38 one by one, and scanning it. LCD driving circuit 57 is a circuit for choosing each display pixel of a liquid crystal one by one, and scanning it.

[0036]Drawing 7 is a flow chart which shows processing by the display 11 gradually, drawing 8 is a sectional view showing the display panel 12 and the manuscript 30 at the time of reading, and drawing 9 is a sectional view showing the printer section 13 and the printing paper 40 at the time of printing. First, in Step s1, when an electric power switch is beforehand switched on by an operator, the program stored in ROM52 is executed and the "read start" button is displayed on the display surface. If an operator does the depression of the "read start" button, the display of a display surface will perform display driving which is cleared and emits light from all the display pixels.

[0037]Next, if an operator makes the manuscript 30 in which the picture was drawn contact the display surface 21, or the display surface 21 is turned to the manuscript 30 and the display panel 12 is made to contact as shown in drawing 8, the manuscript detection sensor 22 will detect the manuscript 30. The manuscript detection sensor 22 will output a manuscript detecting signal to CPU51, if the manuscript 30 is detected. By

this, CPU51 asks ROM52 for an instruction program of operation.

[0038]Next, in Step s2, CPU51 gives reading directions of a picture to the area sensor drive circuit 56 according to the program from ROM52. The area sensor drive circuit 56 chooses the photo detector 38 one by one, operates it, and performs reading of the picture drawn on the manuscript 30. The area sensor drive circuit 56 outputs a reading completion signal to CPU51, after choosing the photo detector 38 of the final column of a final line. CPU51 stores the read image data in the image memory 54 through the subsequent data line 55. The image data for one screen is stored in the image memory 54.

[0039]Next, in Step s3, with directions of CPU51, LCD driving circuit 57 sends the image data stored in the image memory 54 to LCD58 through the data line 55, carries out selection driving of the display pixel one by one, scans it, and displays a picture on a display surface.

[0040]Next, in Step s4, the area sensor drive circuit 56 is driven, and each photo detector 38 is chosen one by one, and is scanned. At this time, CPU51 shifts to "edit mode." In "edit mode", the scan for one screen is continuously performed repeatedly until "edit mode" is canceled. During the scanning drive of the area sensor drive circuit 56, if there is no input from the input pen 14 in the display surface 21, the photo detector 38 will continue receiving outdoor daylight.

[0041]If an operator stands the tip of the input pen 14 to the display surface 21, the tip of the input pen 14 will intercept the outdoor daylight irradiated by the photo detector [ directly under ] 38. If outdoor daylight is intercepted during the drive scan of the area sensor 38a, CPU51 will recognize as the input having been carried out to the coordinates of the photo detector 38 which did not receive light, and will rewrite the image data stored in the image memory 54. Since LCD driving circuit 57 is carrying out the display scanning of the image data from the image memory 54 in LCD part 58, the display of a picture is performed by the edited contents. In "edit mode", the "completion of edit" button is displayed into the display surface 21.

[0042]Next, in Step s5, it is judged by judging whether the "completion of edit" button is pushed whether edit was completed or not. If pushed, "edit mode" is ended, and if not progressed and pushed on the following step s6, it will return to Step s4 and will continue "edit mode." In Step s6, CPU51 recognizes the completion of edit and requires the next directions of ROM52. Directions of print operation are given from ROM52.

[0043]Next, in Step s6, if an operator sets the printing paper 40 to the tray 28 as shown in drawing 9, the sensor 24a will detect the printing paper 40, and will output a

detecting signal to CPU51. In response, CPU51 rotates the transportation rollers 25a and 25b, and conveys the printing paper 40. If the printing paper 40 has inside of the conveyance hole 27 conveyed, the sensor 24b will detect the printing paper 40, and rotation of the transportation rollers 25a and 25b will be suspended. CPU51 sends out a printing controlling signal to the printer section 13, if the detecting signal of the sensor 24b is recognized.

[0044]Next, in Step s7, in response to a printing controlling signal, the printer section 13 reads only the image data for several lines from the image memory 54, and drives the thermal head 26. The thermal head 26 prints image data on the printing paper 40. If printing of the image data for several lines is completed, the transportation rollers 25a and 25b will be rotated, and conveyance movement of the printing paper 40 will be carried out by several printed lines. Printing is completed by repeating this. The printing paper 40 which completed printing is discharged from the outlet 27b.

[0045]Thus, the display 11 is enabling a display and input of reading of a picture and a picture with the single display panel 12, and has realized the various functions device with compact composition.

[0046](A 2nd embodiment) Drawing 10 is a perspective view showing the display panel 70 of the display which is a 2nd embodiment of this invention. The display panel 70 is provided with the glass substrates 71 and 72, the EL luminescence layer 73, and the insulating layers 74 and 75. Two or more electrodes 77 of the shape of a strip of paper prolonged in parallel with the direction of X are formed in the surface of the glass substrate 72 by the side of the EL luminescence layer 73. Two or more electrodes 76 of the shape of a strip of paper prolonged in parallel with the direction [ \*\*\*\* / direction / of X ] of Y are formed in the surface of the glass substrate 71 by the side of the EL luminescence layer 73. The insulating layer 74 intervened between the EL luminescence layer 73 and the glass substrate 71, and has insulated both electrically. The insulating layer 75 intervened between the EL luminescence layer 73 and the glass substrate 72, and has insulated both electrically.

[0047]The EL luminescence layer 73 is pinched and formed among the glass substrates 71 and 72, and emits light with the voltage impressed between the electrode 77 and the electrode 76. The display panel 70 displays by the light from the EL luminescence layer 73 penetrating the glass substrate 71, and being emitted. Two or more photo detectors 78 are arranged and formed in the EL luminescence layer 73 and the surface of the glass substrate 71 of an opposite hand at matrix form.

[0048]Drawing 11 is a sectional view showing the display panel 70 at the time of

reading. All the display pixels of the display panel 50 are made to turn on at the time of reading. Like a 1st embodiment, it hits the manuscript 30, and reflects and the emitted light from the display panel 70 is detected by the photo detector 78. Since the display panel 70 is a spontaneous light type, the back light unit 23 like the display panel 12 is unnecessary.

[0049]Since the composition of those other than display panel 70 of the display which is a 2nd embodiment is the same as that of a 1st embodiment shown in drawing 1 - drawing 9, explanation is omitted.

[0050]Thus, also in a 2nd embodiment, the photo detector 78 is formed in the display surface of the display panel 71, and reading, display, and input of a picture are possible at a display surface.

[0051]Not only PD but other optoelectric transducers may be sufficient as the photo detectors 38 and 78. The printer section 13 may convey not only the method that conveys one sheet of printing paper 40 at a time but the rolled paper 50.

[0052]Drawing 12 is a sectional view showing what changed the printer section 13 into the printer section 83 using the rolled paper 50 in the display 11 of drawing 1. In the printer section 83, the rolled paper 50 is extended and the picture memorized by the image memory 54 is printed on the rolled paper 50 like through and the printer section 13 in the conveyance hole 27.

[0053]

[Effect of the Invention]According to this invention, a picture can be read from a display surface with compact composition as mentioned above. By liquid crystal display, power consumption can be reduced compared with the display panel by a light emitting diode etc., the size of 1 pixel can be made small, and a picture is indicated highly minute. Malfunction, a cross talk, etc. of a display are reduced and display contrast can be improved. The shielding region of light can be held down to minimum and a still higher definition display is possible.

[0054]According to this invention, a picture can be read from a display surface with compact composition. By EL display, power consumption can be reduced compared with the display panel by a light emitting diode etc., the size of 1 pixel can be made small, and a picture is indicated highly minute.

[0055]According to this invention, it is the maximum light volume, and an equivalent light can be used for reading of a picture, and the accuracy of reading can be improved. It can edit an operator's handwritten input being possible and expressing the picture of the read manuscript as easy composition.

[0056]According to this invention, it is convenient to be also able to print a picture and to carry with a display.

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## TECHNICAL FIELD

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[Field of the Invention]This invention relates to the display panel and display for displaying the read picture information while reading two-dimensional picture information.

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## PRIOR ART

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[Description of the Prior Art]Generally as a display of a picture, a CRT (Cathod Ray Tube) display, a liquid crystal display, EL (Electroluminescent) display, etc. are known. These displays are having the input device formed in one, or connected to another input device by a cable, and are enabling the input of the image data for displaying.

[0003]From the display surface of the liquid crystal display panel which displays a picture, there are a device etc. which are indicated to JP,7-152010,A and JP,8-137617,A as a device which performs a pen input. Both arrange the tablet which uses an electrostatic film etc. on the display surface of a liquid crystal display panel, and the input from a display surface is enabled.

[0004]There is a device indicated to JP,2-54591,B from the display surface of the display panel of a light emitting diode as a device which performs a pen input. This is the device which arranged the cell which made the pair the light emitting diode and the light-receiving transistor to matrix form, and constituted the display panel. Furthermore, the pen which has a light-emitting part is used at a tip, and the light-receiving transistor arranged by the display surface with the light emitting diode detects the light from a nib. Thus, the input to a device is performed because a light-receiving transistor detects light.

[0005]JP,8-51521,A is provided with the system which connected the host computer and printer which have a scanner and a display panel. In this system, a picture is read from a scanner, the read picture is displayed on a display panel, the read image data is processed by computer, and the processed picture is printed with the printer.

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## **EFFECT OF THE INVENTION**

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[Effect of the Invention]According to this invention, a picture can be read from a display surface with compact composition as mentioned above. By liquid crystal display, power consumption can be reduced compared with the display panel by a light emitting diode etc., the size of 1 pixel can be made small, and a picture is indicated highly minute. Malfunction, a cross talk, etc. of a display are reduced and display contrast can be improved. The shielding region of light can be held down to minimum and a still higher definition display is possible.

[0054]According to this invention, a picture can be read from a display surface with compact composition. By EL display, power consumption can be reduced compared with the display panel by a light emitting diode etc., the size of 1 pixel can be made small, and a picture is indicated highly minute.

[0055]According to this invention, it is the maximum light volume, and an equivalent light can be used for reading of a picture, and the accuracy of reading can be improved. It can edit an operator's handwritten input being possible and expressing the picture of the read manuscript as easy composition.

[0056]According to this invention, it is convenient to be also able to print a picture and to carry with a display.

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## **TECHNICAL PROBLEM**

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[Problem(s) to be Solved by the Invention]In JP,7-152010,A, JP,8-137617,A, and JP,2-54591,B, an operator has to perform a handwritten input using an input pen, in the picture drawn on the manuscript, the input which can be reproduced faithfully is impossible and input operation also requires time and effort.

[0007]In the display panel indicated to JP,2-54591,B, the light emitting diode is used, and since it drives, comparatively big electric power is needed. Since each pixel is constituted by the single light emitting diode, the size of 1 pixel is comparatively large and the display accuracy of a picture is insufficient.

[0008]Since the system indicated to JP,8-51521,A connects a scanner, a computer, and a printer by a cable and is constituted, a system becomes large-scale and is inconvenient to carry especially.

[0009]The purpose of this invention is to provide the display panel in which a display

possible [ reading of a picture ] and high definition is possible with compact composition. reading and a display of a picture are possible for other purposes of this invention, they can perform edit of a display image if needed, and can print a display image further -- small -- carrying -- it is providing a convenient display.

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## MEANS

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[Means for Solving the Problem]The 1st substrate and the 2nd substrate whose this invention is characterized by that a display panel comprises the following and which countered mutually and have been arranged, A display panel which displays by a thing which were provided with the 1st substrate and a liquid crystal layer which filled up a wooden floor with a liquid crystal and was formed in it the 2nd set, and arranged to matrix form, and for which transmissivity of light of a liquid crystal layer is changed for two or more picture element regions of every.

A signal wire wired between picture element regions on the surface of the 1st substrate that attends the 2nd substrate.

A picture element electrode formed in each picture element region, respectively.

A switching element which is formed in each picture element region, respectively, and controls a flow with a signal wire and a picture element electrode.

This photo detector that are a single flat electrode formed in an entire surface of the 2nd substrate which attends the 1st substrate, and two or more photo detectors arranged by matrix form on a liquid crystal layer of the 2nd substrate, and the surface of an opposite hand, and has been arranged at a position which is in agreement with shade of a switching element, respectively.

[0011]If this invention is followed, luminous intensities which penetrate the 1st substrate, a liquid crystal layer, and the 2nd substrate in this order by changing transmissivity of a liquid crystal layer for every picture element region differ for every picture element region. Thus, a display of a picture etc. is realized by light from which intensity differs for every picture element region being emitted to the exterior from the surface of the 2nd substrate of a liquid crystal layer and an opposite hand. In the surface of the 2nd substrate used as a display surface, two or more photo detectors are arranged and light irradiated from a liquid crystal layer of the 2nd substrate and the outside of an opposite hand is received.

[0012]Thus, since a manuscript in which a picture was drawn, for example since a

photo detector was provided on a display surface can be pressed against a display surface, a picture can be read by receiving light from a picture by a display surface and common use of a display surface and the acceptance surface is moreover carried out, composition of a display panel is dramatically compact.

[0013]Since it is displaying using a liquid crystal, there is little power consumption compared with a display panel by a light emitting diode etc., a size which is 1 pixel can be made small, and a display of a picture is a high definition.

[0014]If this invention is followed, predetermined voltage will be impressed between flat electrodes in which a switching element counters a picture element electrode and this picture element electrode in a picture element region which made it flow through a signal wire and a picture element electrode, an orientation direction of a liquid crystal element will be changed, and transmissivity of light of a liquid crystal layer will change. On the other hand, in a picture element region where a switching element does not make it flow through a signal wire and a picture element region, voltage is not impressed to a liquid crystal layer and transmissivity of light does not change, either. Thus, by using a switching element, since only a display pixel to which transmissivity is changed makes it flow through a signal wire and a picture element electrode and does not make it flow except this, malfunction, a cross talk, etc. of a display are reduced and it can improve display contrast.

[0015]If this invention is furthermore followed, light irradiated among lights which penetrated the 1st substrate by picture element electrode in a picture element region will penetrate a picture element electrode, a liquid crystal layer, and the 2nd substrate, and will be emitted. Light irradiated by switching element in a picture element region is not emitted from a display panel, without being interrupted there and reaching even a liquid crystal layer. Although a photo detector also has non-translucency, since it is located in shade of a switching element, a shielding region is not increased further. Thus, since a shielding region of light can be held down to minimum by putting a switching element and a photo detector in order along a direction of movement of light, a high definition display is possible.

[0016]A display panel this invention is characterized by that comprises the following. The 1st substrate and the 2nd substrate which countered mutually and have been arranged.

The 1st substrate and an EL luminescence layer pinched and formed in a wooden floor the 2nd set.

The 1st insulating layer that intervenes between the 1st substrate and an EL

luminescence layer.

In a display panel which displays by a thing which were provided with the 2nd insulating layer that intervenes between the 2nd substrate and an EL luminescence layer, and arranged to matrix form, and for which prescribed voltage is impressed to an EL luminescence layer for two or more picture element regions of every, Two or more photo detectors arranged by matrix form on an EL luminescence layer of said 2nd substrate, and the surface of an opposite hand.

[0017]If this invention is followed, from an EL luminescence layer, light from which intensity differs for every picture element region will be emitted by impressing prescribed voltage to an EL luminescence layer for every picture element region, and light from an EL luminescence layer will penetrate the 2nd insulating layer and the 2nd substrate in this order. A display of a picture etc. is realized by light from which intensity differs for every picture element region being emitted to the exterior from the surface of an EL luminescence layer and the 2nd substrate of an opposite hand. In the surface of the 2nd substrate used as a display surface, two or more photo detectors are arranged and light irradiated from an EL luminescence layer of the 2nd substrate and the outside of an opposite hand is received.

[0018]Thus, since a manuscript in which a picture was drawn, for example since a photo detector was provided on a display surface can be pressed against a display surface, a picture can be read by receiving light from a picture by a display surface and common use of a display surface and the acceptance surface is moreover carried out, composition of a display panel is dramatically compact.

[0019]Since it is displaying using EL, there is little power consumption compared with a display panel by a light emitting diode etc., a size which is 1 pixel can be made small, and a display of a picture is a high definition.

[0020]For example, two or more 1st electrode and two or more 2nd electrodes as shown below are added as new constituent features of a display panel to a display panel using above-mentioned EL. The 1st electrode is formed in the surface of the 1st substrate which attends an EL luminescence layer, and constitutes the shape of a strip of paper prolonged in parallel with the direction of X. The 2nd electrode is formed in the surface of the 2nd substrate which attends an EL luminescence layer, and constitutes the shape of a strip of paper prolonged in parallel with the direction of Y which intersects perpendicularly in the direction of X.

[0021]If according to such composition it chooses the 1st electrode and the 2nd one electrode at a time and predetermined voltage is impressed among both, arbitrary

picture element regions will be chosen and an EL luminescence layer of this picture element region will emit light. Thus, since an EL luminescence layer of desired arbitrary picture element regions can be made to emit light selectively, if there is a selection driving circuit which chooses an electrode and impresses voltage, it is not necessary to form a drive circuit which drives a picture element region separately for every picture element region, and composition can be simplified.

[0022]A display panel which displays because this invention controls light to which two or more display pixel and two or more photo detectors are arranged and constituted by matrix form, and are emitted for every display pixel, A light-receiving driving means which scans said each photo detector and carries out selection driving one by one, a display driving means which scans said each display pixel and carries out selection driving one by one, and a display which is characterized by comprising the following in order to read a picture of a manuscript.

A reading control means controlled to perform a light-receiving drive while performing display driving to which light is made to emit from all the display pixels.

An image storing means which memorizes image data from a photo detector.

An input member of a pen type which inputs by intercepting outdoor daylight to a photo detector.

A data rewriting means for rewriting data which is equivalent to an input coordinate among image data memorized by an input coordinate detection means to detect a position of a photo detector which had outdoor daylight intercepted as an input coordinate, and image storing means.

[0023]If this invention is followed, light used for a display will be used also for reading of a picture. Thus, since light can be shared to a display and reading of a picture, composition of a device can be simplified. Since it is controlled so that all display pixels emit light when reading a picture of a manuscript, it is the maximum light volume, and an equivalent light can be used for reading of a picture, and accuracy of reading can be improved.

[0024]If this invention is furthermore followed, by intercepting outdoor daylight to a photo detector, a position of this photo detector will be detected as an input coordinate, and data equivalent to this input coordinate will be rewritten. Thus, since image data is rewritten only by intercepting outdoor daylight, it can edit easily, an operator's handwritten input being possible and displaying a picture of a read manuscript. Since a photo detector provided in a display surface is shared for an input from a display surface in order to read a picture of a manuscript, a display, reading, and an input can be

realized from a single display surface, and functions, such as an image editing, can be added with compact composition.

[0025]This invention is provided in said display panel at one, and is provided with a printer section for printing and outputting image data memorized by image storing means.

[0026]Since a printer section is provided in a display panel and one if this invention is followed, it is convenient to be also able to print a picture and to carry with a display.

[0027]

[Embodiment of the Invention]

(A 1st embodiment) Drawing 1 is a perspective view showing the display 11 which is a 1st embodiment of this invention, and drawing 2 is a sectional view showing the display 11. The display 11 is provided with the display panel 12, the printer section 13, and the input pen 14. The display panel 12 is provided with the back light unit 23 directly under the display surface 21, and arranges the manuscript detection sensor 22 on the edge part of the display surface 21. The display panel 12 is a panel which displays a picture on the display surface 21 by using the back light unit 23 as a light source. The back light unit 23 is provided with the cold cathode tube 101 and the reflecting member 102. The cold cathode tube 101 is arranged at the end of a display panel, and is covered with the reflecting member 102. The reflecting member 102 constitutes a curved surface and irradiates a display panel with the light from the cold cathode tube 101 uniformly. The manuscript detection sensor 22 is a sensor for detecting the manuscript mentioned later.

[0028]The display surface 21 is countered, it is joined to the display panel 12 in one, and the printer section 13 is provided with the photosensors 24a and 24b, two or more conveying roller pairs 25, and the thermal head 26. The conveyance hole 27 for conveying printing paper is formed in the printer section 13. It is provided near entrance 27a of the conveyance hole 27, the photosensor 24b is formed near exit 27b of the conveyance hole 27, and the photosensor 24a detects printing paper. The conveying roller pair 25 is a roller pair for putting and conveying printing paper, and is supported pivotally by the conveyance hole 27 side.

[0029]The input pen 14 is a member for comprising the material of non-translucency, accomplishing the shape where the tip sharpened, and performing an input from the display surface 21.

[0030]Drawing 3 is a perspective view showing the structure near [ display surface 21 ] the display panel 12, and drawing 4 is a top view showing the display surface 21. An interval is separated, the plate-like glass substrates 31 and 32 counter mutually, and are

arranged, and the liquid crystal layer 33 which it filled up with the liquid crystal and was formed among these glass substrates 31 and 32 is arranged. Two or more picture element electrodes 34 are arranged and formed in matrix form, and the signal wire 35 is extended and formed in the surface by the side of the liquid crystal layer 33 of the glass substrate 32 in all directions in between these picture element electrodes 34. The picture element electrode 34 covers the field except one corner of a picture element region, and is formed, and the switching element 36 is formed in the field except the picture element electrode 34 in the picture element region, respectively. The switching element 36 is TFT (Thin Film Transistor; thin film transistor) etc. Three terminals of the switching element 36 are connected to the picture element electrode 34 and the signal wire 35 in every direction. The switching element 36 controls a flow with the signal wire 35 and the picture element electrode 34.

[0031]The flat electrode 37 is joined and formed in the surface of the glass substrate 31 which counters the glass substrate 32. In the surface of the flat electrode 37 and the glass substrate 31 of an opposite hand, the one photo detector 38 is formed at a time in the position corresponding to each switching element 36. The photo detector 38 is PD (PhotoDiode; photo-diode) etc. which comprise a-Si (amorphous silicon). The signal wire 39 is formed in the position corresponding to each signal wire 35. Thus, it is located in the shade of the switching element 36, the signal wire 35 is located in the shade of the signal wire 39, and the photo detector 38 can hold down a shielding region to minimum.

[0032]The display panel 12 comprises the photo detector (a 640x480-pixel display pixel and 640x480 pixels) 38, and drawing 3 shows the part. The display panel 12 is not restricted to a 640x480-pixel thing. All the display pixels constitute the LCD (Liquid Crystal Display) section 58, and all the photo detectors 38 assume that the area sensor 38a is constituted.

[0033]Drawing 5 is a circuit diagram showing an electric connection structure of the photo detector 38. The one photo detector 38 is also chosen at a time one by one by choosing the one signal wire 39 of a line writing direction and a column direction at a time, respectively. Predetermined bias voltage is impressed to the selected photo detector 38. The signal wire 39 connected to the selected photo detector 38 flows with the amplifier 41 selectively with the switch 42. The switch 42 makes the amplifier 41 flow through the selected signal wire 39, and grounds the other signal wire 39. When the selected photo detector 38 detects light, the signal amplified from the amplifier 41 is outputted.

[0034]Drawing 6 is a block diagram showing the electric composition of the display 11. The display 11 is added to the composition shown in drawing 1, CPU (Central Processing.) It has Unit51, ROM(Read Only Memory) 52, RAM(Random Access Memory) 53, the image memory 54, the data line 55, the area sensor drive circuit 56, and LCD driving circuit 57.

[0035]According to directions of ROM52, the area sensor drive circuit 56, LCD driving circuit 57, and the printer section 13 are controlled, and CPU51 performs control which stores or reads image data to the image memory 54. The program for generalizing and controlling CPU51 is beforehand written in ROM52. RAM53 is a memory which evacuates temporarily the data calculated by CPU51. The image memory 54 is a memory for storing and saving the image data for one screen. The data line 55 is a signal wire for transmitting the image data which read to each block. The area sensor drive circuit 56 is a circuit for choosing each photo detector 38 one by one, and scanning it. LCD driving circuit 57 is a circuit for choosing each display pixel of a liquid crystal one by one, and scanning it.

[0036]Drawing 7 is a flow chart which shows processing by the display 11 gradually, drawing 8 is a sectional view showing the display panel 12 and the manuscript 30 at the time of reading, and drawing 9 is a sectional view showing the printer section 13 and the printing paper 40 at the time of printing. First, in Step s1, when an electric power switch is beforehand switched on by an operator, the program stored in ROM52 is executed and the "read start" button is displayed on the display surface. If an operator does the depression of the "read start" button, the display of a display surface will perform display driving which is cleared and emits light from all the display pixels.

[0037]Next, if an operator makes the manuscript 30 in which the picture was drawn contact the display surface 21, or the display surface 21 is turned to the manuscript 30 and the display panel 12 is made to contact as shown in drawing 8, the manuscript detection sensor 22 will detect the manuscript 30. The manuscript detection sensor 22 will output a manuscript detecting signal to CPU51, if the manuscript 30 is detected. By this, CPU51 asks ROM52 for an instruction program of operation.

[0038]Next, in Step s2, CPU51 gives reading directions of a picture to the area sensor drive circuit 56 according to the program from ROM52. The area sensor drive circuit 56 chooses the photo detector 38 one by one, operates it, and performs reading of the picture drawn on the manuscript 30. The area sensor drive circuit 56 outputs a reading completion signal to CPU51, after choosing the photo detector 38 of the final column of a final line. CPU51 stores the read image data in the image memory 54 through the

subsequent data line 55. The image data for one screen is stored in the image memory 54.

[0039]Next, in Step s3, with directions of CPU51, LCD driving circuit 57 sends the image data stored in the image memory 54 to LCD58 through the data line 55, carries out selection driving of the display pixel one by one, scans it, and displays a picture on a display surface.

[0040]Next, in Step s4, the area sensor drive circuit 56 is driven, and each photo detector 38 is chosen one by one, and is scanned. At this time, CPU51 shifts to "edit mode." In "edit mode", the scan for one screen is continuously performed repeatedly until "edit mode" is canceled. During the scanning drive of the area sensor drive circuit 56, if there is no input from the input pen 14 in the display surface 21, the photo detector 38 will continue receiving outdoor daylight.

[0041]If an operator stands the tip of the input pen 14 to the display surface 21, the tip of the input pen 14 will intercept the outdoor daylight irradiated by the photo detector [ directly under ] 38. If outdoor daylight is intercepted during the drive scan of the area sensor 38a, CPU51 will recognize as the input having been carried out to the coordinates of the photo detector 38 which did not receive light, and will rewrite the image data stored in the image memory 54. Since LCD driving circuit 57 is carrying out the display scanning of the image data from the image memory 54 in LCD part 58, the display of a picture is performed by the edited contents. In "edit mode", the "completion of edit" button is displayed into the display surface 21.

[0042]Next, in Step s5, it is judged by judging whether the "completion of edit" button is pushed whether edit was completed or not. If pushed, "edit mode" is ended, and if not progressed and pushed on the following step s6, it will return to Step s4 and will continue "edit mode." In Step s6, CPU51 recognizes the completion of edit and requires the next directions of ROM52. Directions of print operation are given from ROM52.

[0043]Next, in Step s6, if an operator sets the printing paper 40 to the tray 28 as shown in drawing 9, the sensor 24a will detect the printing paper 40, and will output a detecting signal to CPU51. In response, CPU51 rotates the transportation rollers 25a and 25b, and conveys the printing paper 40. If the printing paper 40 has inside of the conveyance hole 27 conveyed, the sensor 24b will detect the printing paper 40, and rotation of the transportation rollers 25a and 25b will be suspended. CPU51 sends out a printing controlling signal to the printer section 13, if the detecting signal of the sensor 24b is recognized.

[0044]Next, in Step s7, in response to a printing controlling signal, the printer section

13 reads only the image data for several lines from the image memory 54, and drives the thermal head 26. The thermal head 26 prints image data on the printing paper 40. If printing of the image data for several lines is completed, the transportation rollers 25a and 25b will be rotated, and conveyance movement of the printing paper 40 will be carried out by several printed lines. Printing is completed by repeating this. The printing paper 40 which completed printing is discharged from the outlet 27b.

[0045]Thus, the display 11 is enabling a display and input of reading of a picture and a picture with the single display panel 12, and has realized the various functions device with compact composition.

[0046](A 2nd embodiment) Drawing 10 is a perspective view showing the display panel 70 of the display which is a 2nd embodiment of this invention. The display panel 70 is provided with the glass substrates 71 and 72, the EL luminescence layer 73, and the insulating layers 74 and 75. Two or more electrodes 77 of the shape of a strip of paper prolonged in parallel with the direction of X are formed in the surface of the glass substrate 72 by the side of the EL luminescence layer 73. Two or more electrodes 76 of the shape of a strip of paper prolonged in parallel with the direction [ \*\*\*\* / direction / of X ] of Y are formed in the surface of the glass substrate 71 by the side of the EL luminescence layer 73. The insulating layer 74 intervened between the EL luminescence layer 73 and the glass substrate 71, and has insulated both electrically. The insulating layer 75 intervened between the EL luminescence layer 73 and the glass substrate 72, and has insulated both electrically.

[0047]The EL luminescence layer 73 is pinched and formed among the glass substrates 71 and 72, and emits light with the voltage impressed between the electrode 77 and the electrode 76. The display panel 70 displays by the light from the EL luminescence layer 73 penetrating the glass substrate 71, and being emitted. Two or more photo detectors 78 are arranged and formed in the EL luminescence layer 73 and the surface of the glass substrate 71 of an opposite hand at matrix form.

[0048]Drawing 11 is a sectional view showing the display panel 70 at the time of reading. All the display pixels of the display panel 50 are made to turn on at the time of reading. Like a 1st embodiment, it hits the manuscript 30, and reflects and the emitted light from the display panel 70 is detected by the photo detector 78. Since the display panel 70 is a spontaneous light type, the back light unit 23 like the display panel 12 is unnecessary.

[0049]Since the composition of those other than display panel 70 of the display which is a 2nd embodiment is the same as that of a 1st embodiment shown in drawing 1 -

drawing 9, explanation is omitted.

[0050]Thus, also in a 2nd embodiment, the photo detector 78 is formed in the display surface of the display panel 71, and reading, display, and input of a picture are possible at a display surface.

[0051]Not only PD but other optoelectric transducers may be sufficient as the photo detectors 38 and 78. The printer section 13 may convey not only the method that conveys one sheet of printing paper 40 at a time but the rolled paper 50.

[0052]Drawing 12 is a sectional view showing what changed the printer section 13 into the printer section 83 using the rolled paper 50 in the display 11 of drawing 1. In the printer section 83, the rolled paper 50 is extended and the picture memorized by the image memory 54 is printed on the rolled paper 50 like through and the printer section 13 in the conveyance hole 27.

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## **DESCRIPTION OF DRAWINGS**

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[Brief Description of the Drawings]

[Drawing 1]It is a perspective view showing the display 11 which is a 1st embodiment of this invention.

[Drawing 2]It is a sectional view showing the display 11.

[Drawing 3]It is a perspective view showing the display panel 12 of drawing 2.

[Drawing 4]It is a top view showing the display panel 12.

[Drawing 5]It is a circuit diagram showing an electric connection structure of the area sensor 38a.

[Drawing 6]It is a block diagram showing the electric composition of the display 11.

[Drawing 7]It is a flow chart which shows processing by the display 11 gradually.

[Drawing 8]It is a sectional view showing the display panel 12 at the time of reading.

[Drawing 9]It is a sectional view showing the printer section 13 at the time of printing.

[Drawing 10]It is a perspective view showing the display panel 70 of the display which is a 2nd embodiment of this invention.

[Drawing 11]It is a sectional view showing the display panel 70 at the time of reading.

[Drawing 12]It is a sectional view showing the display which uses the rolled paper 50.

[Description of Notations]

11 Display

12, 70 display panels

13 Printer section  
21 Display surface  
31, 32, 71, 72 glass substrates  
33 Liquid crystal layer  
34 Picture element electrode  
35 and 39 Signal wire  
36 Switching element  
37 Flat electrode  
38 Photo detector  
38a Area sensor  
51 CPU  
54 Image memory  
56 Area sensor drive circuit  
57 LCD driving circuit  
73 EL luminescence layer  
74 and 75 Insulating layer

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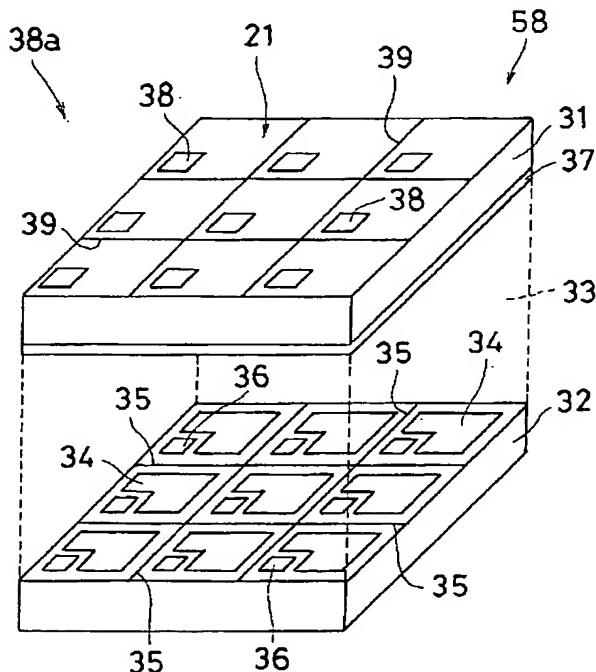
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(54)【発明の名称】 表示パネルおよび表示装置

(57)【要約】

【課題】 コンパクトな構成で画像の読み取りが可能、かつ高精細な表示が可能な表示パネルを提供する。

【解決手段】 画素領域ごとに液晶層33の透過率を変化させることで、ガラス基板32、液晶層33およびガラス基板31をこの順に透過する光の強度は、画素領域ごとに異なる。このように画素領域ごとに強度の異なる光が、液晶層33と反対側のガラス基板31の表面から外部へ射出されることで、画像などの表示が実現される。表示面となるガラス基板31の表面には、複数の受光素子38が配列されており、ガラス基板31の液晶層33と反対側の外部から照射された光を受光する。画像からの光を表示面で受光することで、画像を読み込むことができる。不透光性の受光素子38は、同じく不透光性のスイッチング素子36の陰に配置されるので、遮光領域を最低限に抑えることができる。



## 【特許請求の範囲】

【請求項1】 互いに対向して配置された第1基板および第2基板と、第1基板および第2基板の間に液晶を充填して形成された液晶層とを備え、マトリクス状に配列した複数の画素領域ごとに、液晶層の光の透過率を変化させることで表示を行う表示パネルにおいて、第2基板に臨む第1基板の表面上で、画素領域の間に配線された信号線と、各画素領域内にそれぞれ形成された画素電極と、各画素領域内にそれぞれ形成され、信号線と画素電極との導通を制御するスイッチング素子と、第1基板に臨む第2基板の表面全面に形成された単一の平面電極と、第2基板の液晶層と反対側の表面上にマトリクス状に配列された複数の受光素子であって、スイッチング素子の陰に一致する位置にそれぞれ配置された該受光素子とを備えることを特徴とする表示パネル。

【請求項2】 互いに対向して配置された第1基板および第2基板と、第1基板および第2基板の間に挟まれて形成されたEL発光層と、第1基板およびEL発光層の間に介在する第1絶縁層と、第2基板およびEL発光層の間に介在する第2絶縁層とを備え、マトリクス状に配列した複数の画素領域ごとに、EL発光層に所定電圧を印加することで表示を行う表示パネルにおいて、前記第2基板のEL発光層と反対側の表面上に、マトリクス状に配列された複数の受光素子を備えることを特徴とする表示パネル。

【請求項3】 複数の表示画素および複数の受光素子がマトリクス状に配列されて構成され、表示画素ごとに射される光を制御することで表示を行う表示パネルと、前記各受光素子を走査して順次選択駆動する受光駆動手段と、

前記各表示画素を走査して順次選択駆動する表示駆動手段と、

原稿の画像を読み取るために、全表示画素から光を射出させる表示駆動を行うとともに受光駆動を行うように制御する読み取制御手段と、

受光素子からの画像データを記憶する画像記憶手段と、受光素子への外光を遮断することで入力を行うペン型の入力部材と、

外光を遮断された受光素子の位置を入力座標として検出する入力座標検出手段と、

画像記憶手段に記憶された画像データのうち、入力座標に相当するデータを書き換えるためのデータ書換手段と

を備えることを特徴とする表示装置。

【請求項4】 前記表示パネルに一体に設けられ、画像記憶手段に記憶された画像データを印刷して出力するためのプリンタ部を備えることを特徴とする請求項3記載の表示装置。

## 【発明の詳細な説明】

## 【0001】

【発明の属する技術分野】 本発明は、2次元の画像情報を読み取るとともに、読み取った画像情報を表示するための表示パネルおよび表示装置に関する。

## 【0002】

【従来の技術】 画像の表示装置として、一般的に、CRT (Cathod Ray Tube) 表示装置、液晶表示装置やEL (Electroluminescent) 表示装置などが知られている。これらの表示装置は、一体に形成された入力装置を備えるか、または別の入力装置にケーブルで接続されることで、表示するための画像データの入力を可能としている。

【0003】 画像の表示を行う液晶表示パネルの表示面から、ペン入力を行う装置として、特開平7-152010および特開平8-137617に記載される装置などがある。どちらも、静電フィルムなどを使用したタブレットを液晶表示パネルの表示面上に配置しており、表示面からの入力を可能としている。

【0004】 また、発光ダイオードの表示パネルの表示面から、ペン入力を行う装置として、特公平2-54591に記載される装置がある。これは、発光ダイオードと受光トランジスタとを対にしたセルをマトリクス状に配列して表示パネルを構成した装置である。さらに先端に発光部を有するペンを使用しており、表示面に発光ダイオードとともに配列された受光トランジスタは、ペン先からの光を検出する。このように、受光トランジスタが光を検出することで、装置に対する入力が行われる。

【0005】 さらに、特開平8-51521には、スキヤナ、表示パネルを有するホストコンピュータおよびプリンタを接続したシステムが提供されている。このシステムでは、スキヤナから画像を読み込み、読み込んだ画像を表示パネルに表示し、読み込んだ画像データをコンピュータで加工し、加工された画像をプリンタによって印刷している。

## 【0006】

【発明が解決しようとする課題】 特開平7-152010、特開平8-137617および特公平2-54591では、操作者が入力ペンを使用して手書き入力を行わなければならず、原稿に描かれた画像を忠実に再現できるような入力は不可能であり、入力作業も手間がかかる。

【0007】 また、特公平2-54591に記載される表示パネルでは、発光ダイオードを使用しており、駆動するために比較的大きな電力を必要とする。また、各画

素は単一の発光ダイオードによって構成されるので、1画素の寸法が比較的大きく、画像の表示精度は不十分である。

【0008】さらに、特開平8-51521に記載されるシステムは、スキャナ、コンピュータおよびプリンタをケーブルで接続して構成されるので、システムが大規模になり、特に、携帯するには不便である。

【0009】本発明の目的は、コンパクトな構成で画像の読み取りが可能、かつ高精細な表示が可能な表示パネルを提供することである。また本発明の他の目的は、画像の読み取りおよび表示が可能であり、必要に応じて表示画像の編集ができ、さらに表示画像を印刷できる小型で携帯便利な表示装置を提供することである。

#### 【0010】

【課題を解決するための手段】本発明は、互いに対向して配置された第1基板および第2基板と、第1基板および第2基板の間に液晶を充填して形成された液晶層とを備え、マトリクス状に配列した複数の画素領域ごとに、液晶層の光の透過率を変化させることで表示を行う表示パネルにおいて、第2基板に臨む第1基板の表面上で、画素領域の間に配線された信号線と、各画素領域内にそれぞれ形成された画素電極と、各画素領域内にそれぞれ形成され、信号線と画素電極との導通を制御するスイッチング素子と、第1基板に臨む第2基板の表面全面に形成された单一の平面電極と、第2基板の液晶層と反対側の表面上にマトリクス状に配列された複数の受光素子であって、スイッチング素子の陰に一致する位置にそれぞれ配置された該受光素子とを備えることを特徴とする表示パネルである。

【0011】本発明に従えば、画素領域ごとに液晶層の透過率を変化させることで、第1基板、液晶層および第2基板をこの順に透過する光の強度は、画素領域ごとに異なる。このように画素領域ごとに強度の異なる光が、液晶層と反対側の第2基板の表面から外部へ出射されることで、画像などの表示が実現される。表示面となる第2基板の表面には、複数の受光素子が配列されており、第2基板の液晶層と反対側の外部から照射された光を受光する。

【0012】このように、表示面上に受光素子が設けられるので、たとえば画像の描かれた原稿を表示面に押し当て、画像からの光を表示面で受光することで、画像を読み込むことができ、しかも表示面および受光面が共用化されているので、表示パネルの構成は非常にコンパクトである。

【0013】また、液晶を使って表示しているので、発光ダイオードなどによる表示パネルに比べて消費電力が少なく、1画素の寸法を小さくすることができ、画像の表示は高精細である。

【0014】また本発明に従えば、スイッチング素子が信号線と画素電極とを導通させた画素領域では、画素電

極および該画素電極に対向する平面電極との間に所定の電圧が印加され、液晶分子の配向方向が変更されて液晶層の光の透過率が変化する。一方、スイッチング素子が信号線と画素領域とを導通させない画素領域では、液晶層に電圧が印加されず、光の透過率も変化しない。このように、スイッチング素子を使用することで、透過率を変化させる表示画素だけ、信号線と画素電極とを導通させ、これ以外は導通をさせないので、表示の誤動作やクロストークなどが軽減され、表示コントラストを向上することができる。

【0015】さらに本発明に従えば、第1基板を透過した光のうち、画素領域内の画素電極に照射された光は画素電極、液晶層、第2基板を透過して出射される。画素領域内のスイッチング素子に照射された光は、そこで遮られて液晶層にまで到達せずに、表示パネルからは出射されない。受光素子も不透光性を有するが、スイッチング素子の陰に位置するので、さらに遮光領域を増やすことはない。このように、スイッチング素子および受光素子を光の進行方向に沿って並べることで、光の遮光領域を最低限に抑えることができるので、高精細な表示が可能である。

【0016】また本発明は、互いに対向して配置された第1基板および第2基板と、第1基板および第2基板の間に挟まれて形成されたEL発光層と、第1基板およびEL発光層の間に介在する第1絶縁層と、第2基板およびEL発光層の間に介在する第2絶縁層とを備え、マトリクス状に配列した複数の画素領域ごとに、EL発光層に所定電圧を印加することで表示を行う表示パネルにおいて、前記第2基板のEL発光層と反対側の表面上に、マトリクス状に配列された複数の受光素子を備えることを特徴とする表示パネルである。

【0017】本発明に従えば、画素領域ごとにEL発光層に所定電圧を印加することで、EL発光層からは画素領域ごとに強度の異なる光が発せられ、EL発光層からの光は、第2絶縁層、第2基板をこの順に透過する。画素領域ごとに強度の異なる光が、EL発光層と反対側の第2基板の表面から外部へ出射されることで、画像などの表示が実現される。表示面となる第2基板の表面には、複数の受光素子が配列されており、第2基板のEL発光層と反対側の外部から照射された光を受光する。

【0018】このように、表示面上に受光素子が設けられるので、たとえば画像の描かれた原稿を表示面に押し当て、画像からの光を表示面で受光することで、画像を読み込むことができ、しかも表示面および受光面が共用化されているので、表示パネルの構成は非常にコンパクトである。

【0019】また、ELを使って表示しているので、発光ダイオードなどによる表示パネルに比べて消費電力が少なく、1画素の寸法を小さくすることができ、画像の表示は高精細である。

【0020】なお、たとえば上記ELを用いた表示パネルに対して、下記に示すような複数の第1電極および複数の第2電極を表示パネルの新たな構成要件として追加する。第1電極は、EL発光層に臨む第1基板の表面に形成され、X方向に平行に延びる短冊状を成す。第2電極は、EL発光層に臨む第2基板の表面に形成され、X方向に直交するY方向に平行に延びる短冊状を成す。

【0021】このような構成によれば、第1電極および第2電極を1個ずつ選択して両者の間に所定の電圧を印加すると、任意の画素領域が選択されて該画素領域のEL発光層は発光する。このように、所望の任意の画素領域のEL発光層を選択的に発光させることができるので、電極を選択して電圧を印加する選択駆動回路があれば、画素領域を個々に駆動する駆動回路を各画素領域ごとに形成する必要がなく、構成を簡略化できる。

【0022】また本発明は、複数の表示画素および複数の受光素子がマトリクス状に配列されて構成され、表示画素ごとに射出される光を制御することで表示を行う表示パネルと、前記各受光素子を走査して順次選択駆動する受光駆動手段と、前記各表示画素を走査して順次選択駆動する表示駆動手段と、原稿の画像を読取るために、全表示画素から光を射出させる表示駆動を行うとともに受光駆動を行うように制御する読取制御手段と、受光素子からの画像データを記憶する画像記憶手段と、受光素子への外光を遮断することで入力を行うペン型の入力部材と、外光を遮断された受光素子の位置を入力座標として検出する入力座標検出手段と、画像記憶手段に記憶された画像データのうち、入力座標に相当するデータを書き換えるためのデータ書換手段とを備えることを特徴とする表示装置である。

【0023】本発明に従えば、表示のために用いられる光は、画像の読み取りのためにも使用される。このように、光を画像の表示および読み取りに共用することができるので、装置の構成を簡易にすることができる。また、原稿の画像を読み取るときには、全部の表示画素が光を射出するように制御されるので、最大光量でかつ均等な光を画像の読み取りに利用することができ、読み取りの精度を向上することができる。

【0024】さらに本発明に従えば、受光素子への外光を遮断することで、該受光素子の位置が入力座標として検出され、該入力座標に相当するデータが書換えられる。このように、外光を遮断するだけで画像データが書換えられるので、操作者の手書き入力が可能であり、読み取った原稿の画像を表示しながら簡単に編集することができる。また、原稿の画像を読み取るために表示面に設けられた受光素子を、表示面からの入力のために共用するので、表示、読み取りおよび入力が单一の表示面から実現でき、コンパクトな構成で、画像編集などの機能を追加することができる。

【0025】また本発明は、前記表示パネルに一体に設

けられ、画像記憶手段に記憶された画像データを印刷して出力するためのプリンタ部を備えることを特徴とする。

【0026】本発明に従えば、プリンタ部が表示パネルと一緒に設けられているので、表示装置で画像を印刷することもでき、携帯するのに便利である。

【0027】

#### 【発明の実施の形態】

(第1実施形態) 図1は、本発明の第1実施形態である表示装置11を示す斜視図であり、図2は、表示装置11を示す断面図である。表示装置11は、表示パネル12、プリンタ部13および入力ペン14を備える。表示パネル12は、表示面21の直下にバックライトユニット23を備え、表示面21の周縁部に原稿検出センサ22を配する。表示パネル12は、バックライトユニット23を光源として表示面21に画像を表示するパネルである。バックライトユニット23は、冷陰極管101および反射部材102を備える。冷陰極管101は、表示パネルの一端に配置されて、反射部材102に覆われる。反射部材102は曲面を成し、冷陰極管101からの光を均等に表示パネルに照射する。原稿検出センサ22は、後述する原稿を検出するためのセンサである。

【0028】プリンタ部13は、表示面21に対向して表示パネル12に一体化して接合され、フォトセンサ24a、24b、複数の搬送ローラ対25、およびサーマルヘッド26を備える。プリンタ部13には、印刷紙を搬送するための搬送孔27が設けられている。フォトセンサ24aは、搬送孔27の入口27a付近に設けられ、フォトセンサ24bは、搬送孔27の出口27b付近に設けられ、印刷紙を検出する。搬送ローラ対25は、印刷紙を挟み込んで搬送するためのローラ対であり、搬送孔27脇に軸支されている。

【0029】入力ペン14は、不透光性の材料から成り、先端が尖った形状を成し、表示面21から入力をを行うための部材である。

【0030】図3は、表示パネル12の表示面21付近の構造を示す斜視図であり、図4は、表示面21を示す平面図である。平板状のガラス基板31、32が、間隔を隔てて互いに対向して配置され、該ガラス基板31、32の間に、液晶が充填されて形成された液晶層33が配置される。ガラス基板32の液晶層33側の表面には、マトリクス状に複数の画素電極34が配列されて形成され、該画素電極34の間を縦横に信号線35が延びて形成されている。画素電極34は画素領域の一角を除く領域を覆って形成され、画素領域内で画素電極34を除く領域にそれぞれスイッチング素子36が設けられている。スイッチング素子36は、TFT(Thin Film Transistor；薄膜トランジスタ)などである。スイッチング素子36の3端子は、画素電極34および縦横の信号線35に接続される。スイッチング素子36は、信号線

35と画素電極34との導通を制御する。

【0031】ガラス基板32に対向するガラス基板31の表面には、平面電極37が接合して設けられている。平面電極37と反対側のガラス基板31の表面において、各スイッチング素子36に対応する位置に、受光素子38が1個ずつ設けられる。受光素子38は、a-Si(アモルファスシリコン)から成るP-D(Photodiode; フォトダイオード)などである。各信号線35に対応する位置に、信号線39が設けられる。このように、受光素子38はスイッチング素子36の陰に位置しており、信号線35は信号線39の陰に位置しており、遮光領域を最低限に抑えることができる。

【0032】なお、表示パネル12は、 $640 \times 480$ 画素の表示画素および $640 \times 480$ 画素の受光素子38から構成されており、図3はその一部を示している。また、表示パネル12は、 $640 \times 480$ 画素のものに限らない。全表示画素は、LCD(Liquid Crystal Display)部58を構成し、全受光素子38は、エリアセンサ38aを構成しているものとする。

【0033】図5は、受光素子38の電気的な接続構造を示す回路図である。順次、行方向および列方向の信号線39をそれぞれ1本ずつ選択していくことで、受光素子38も1個ずつ順次選択される。選択された受光素子38には、所定のバイアス電圧が印加される。選択された受光素子38に接続された信号線39は、スイッチ42によって選択的にアンプ41と導通される。スイッチ42は、選択された信号線39をアンプ41に導通させ、それ以外の信号線39を接地させる。選択された受光素子38が光を検出したときに、アンプ41から増幅された信号が出力される。

【0034】図6は、表示装置11の電気的な構成を示すブロック図である。表示装置11は、図1に示す構成に加えて、CPU(Central Processing Unit)51、ROM(Read Only Memory)52、RAM(Random Access Memory)53、画像メモリ54、データ線55、エリアセンサ駆動回路56およびLCD駆動回路57を備える。

【0035】CPU51は、ROM52の指示にしたがってエリアセンサ駆動回路56、LCD駆動回路57およびプリンタ部13を制御し、画像データを画像メモリ54へ格納したり、読み出したりする制御を行う。ROM52には、CPU51を統括して制御するためのプログラムを予め書き込んである。RAM53は、CPU51によって演算されたデータを一時退避しておくメモリである。画像メモリ54は、1画面分の画像データを格納して保存しておくためのメモリである。データ線55は、読み取りを行った画像データを各ブロックに転送するための信号線である。エリアセンサ駆動回路56は、各受光素子38を順次選択して走査するための回路である。LCD駆動回路57は、液晶の各表示画素を順次選

択して走査するための回路である。

【0036】図7は、表示装置11による処理を段階的に示すフローチャートであり、図8は、読み取時の表示パネル12および原稿30を示す断面図であり、図9は、印刷時のプリンタ部13および印刷紙40を示す断面図である。まず、ステップs1において、予め操作者によって電源スイッチを投入したときに、ROM52に格納されたプログラムが実行されており、表示面には「読み取開始」ボタンが表示されている。操作者が「読み取開始」ボタンを押下すると、表示面の表示はクリアされて全表示画素から光を射出する表示駆動を行う。

【0037】次に、図8に示されるように、操作者が画像の描かれた原稿30を表示面21に当接させるか、または表示パネル12を表示面21を原稿30に向けて当接させると、原稿検出センサ22が原稿30を検出す。原稿検出センサ22は、原稿30を検出するとCPU51に原稿検出信号を出力する。これによって、CPU51はROM52に動作の指示プログラムを請求する。

【0038】次にステップs2において、ROM52からのプログラムに従ってCPU51は、エリアセンサ駆動回路56に画像の読み取り指示を与える。エリアセンサ駆動回路56は、受光素子38を順次選択して操作し、原稿30に描かれた画像の読み取りを実行する。エリアセンサ駆動回路56は、最終行の最終列の受光素子38を選択した後、読み取完了信号をCPU51に出力する。CPU51は、読み取った画像データを順次データ線55を通して画像メモリ54に格納する。画像メモリ54に、1画面分の画像データが格納される。

【0039】次にステップs3において、CPU51の指示により、LCD駆動回路57は画像メモリ54に格納されている画像データをデータ線55を通してLCD58に送り、表示画素を順次選択駆動して走査し、画像を表示面に表示する。

【0040】次にステップs4において、エリアセンサ駆動回路56を駆動して、各受光素子38を順次選択して走査する。このときCPU51は、「編集モード」に移行する。「編集モード」では、「編集モード」が解除されるまで、1画面分の走査を連続して何度も行う。エリアセンサ駆動回路56の走査駆動中に、表示面21に入力ペン14からの入力がなければ、受光素子38は外光を受光し続ける。

【0041】操作者が入力ペン14の先端を表示面21に立てると、入力ペン14の先端は直下の受光素子38に照射される外光を遮断する。エリアセンサ38aの駆動走査中に、外光が遮断されると、CPU51は受光しなかった受光素子38の座標に入力がされたものと認識し、画像メモリ54に格納されている画像データを書き換える。LCD駆動回路57は、画像メモリ54からの画像データをLCD部58において表示走査しているの

で、画像の表示は編集された内容で行われる。なお、「編集モード」では表示面21中に「編集完了」ボタンを表示しておく。

【0042】次にステップs5において、「編集完了」ボタンが押下されているかどうかを判断することで、編集が完了したかどうかを判断する。押下されていれば、「編集モード」を終了して、次のステップs6に進み、押下されていなければ、ステップs4に戻って「編集モード」を続行する。ステップs6では、CPU51は編集完了を認識し、ROM52に次の指示を要求する。ROM52からは、印刷動作の指示が与えられる。

【0043】次にステップs6において、図9に示すように、操作者が印刷紙40をトレイ28にセットすると、センサ24aが印刷紙40を検出し、検出信号をCPU51に出力する。CPU51はこれを受けて、搬送ローラ25a, 25bを回転させて印刷紙40を搬送する。印刷紙40が搬送孔27内を搬送されていくと、センサ24bが印刷紙40を検出し、搬送ローラ25a, 25bの回転が停止される。CPU51は、センサ24bの検出信号を認識すると、プリンタ部13に印刷制御信号を送出する。

【0044】次にステップs7では、プリンタ部13は、印刷制御信号を受けて、画像メモリ54から数ライン分の画像データだけを読み出してサーマルヘッド26を駆動する。サーマルヘッド26は、印刷紙40に画像データを印刷する。数ライン分の画像データの印刷が終了したら、搬送ローラ25a, 25bを回転させ、印刷した数ライン分だけ印刷紙40を搬送移動させる。これを繰り返すことで、印刷を完了する。印刷を完了した印刷紙40は、排出口27bから排出される。

【0045】このように、表示装置11は、単一の表示パネル12で画像の読み取り、画像の表示および入力を可能としており、コンパクトな構成で多機能な装置を実現している。

【0046】(第2実施形態) 図10は、本発明の第2実施形態である表示装置の表示パネル70を示す斜視図である。表示パネル70は、ガラス基板71, 72、EL発光層73、絶縁層74, 75を備える。EL発光層73側のガラス基板72の表面には、X方向に平行に延びる短冊状の複数の電極77が形成されている。EL発光層73側のガラス基板71の表面には、X方向に直交なY方向に平行に延びる短冊状の複数の電極76が形成されている。絶縁層74は、EL発光層73およびガラス基板71の間に介在し、両者を電気的に絶縁している。絶縁層75は、EL発光層73およびガラス基板72の間に介在し、両者を電気的に絶縁している。

【0047】EL発光層73は、ガラス基板71, 72の間に挟まれて形成され、電極77および電極76の間に印加される電圧によって発光する。表示パネル70は、EL発光層73からの光がガラス基板71を透過し

て出射されることで表示を行う。EL発光層73と反対側のガラス基板71の表面には、複数の受光素子78がマトリクス状に配列されて形成される。

【0048】図11は、読み取時の表示パネル70を示す断面図である。読み取時には、表示パネル50の全表示画素を点灯させる。表示パネル70からの出射光は、第1実施形態と同様に、原稿30に当たって反射し、受光素子78に検出される。表示パネル70は自発光型であるので、表示パネル12のようなバックライトユニット21は不要である。

【0049】第2実施形態である表示装置の表示パネル70以外の構成は、図1～図9に示した第1実施形態と同様であるので説明を省略する。

【0050】このように、第2実施形態においても、表示パネル71の表示面に受光素子78が形成されており、表示面で画像の読み取り、表示および入力が可能である。

【0051】なお、受光素子38, 78はPDに限らず、他の光電変換素子でもよい。また、プリンタ部13は、印刷紙40を1枚ずつ搬送する方式に限らず、ロール紙50を搬送するものでもよい。

【0052】図12は、図1の表示装置11において、プリンタ部13をロール紙50を使うプリンタ部83に変更したもの示す断面図である。プリンタ部83では、ロール紙50を延ばして搬送孔27内に通し、プリンタ部13と同様に、画像メモリ54に記憶された画像をロール紙50に印刷する。

【0053】  
【発明の効果】以上のように本発明によれば、コンパクトな構成で、表示面から画像を読み込むことができる。また、液晶表示によって、発光ダイオードなどによる表示パネルに比べて消費電力を低減でき、1画素の寸法を小さくすることができ、画像の表示を高精細にできる。さらに、表示の誤動作やクロストークなどが軽減され、表示コントラストを向上することができる。さらに、光の遮光領域を最低限に抑えることができ、さらに高精細な表示が可能である。

【0054】また本発明によれば、コンパクトな構成で、表示面から画像を読み込むことができる。また、EL表示によって、発光ダイオードなどによる表示パネルに比べて消費電力を低減でき、1画素の寸法を小さくすることができ、画像の表示を高精細にできる。

【0055】また本発明によれば、最大光量でかつ均等な光を画像の読み取りに利用することができ、読み取りの精度を向上することができる。また、簡単な構成で、操作者の手書き入力が可能であり、読み取った原稿の画像を表示しながら編集することができる。

【0056】また本発明によれば、表示装置で画像を印刷することもでき、携帯するのに便利である。

50 【画面の簡単な説明】

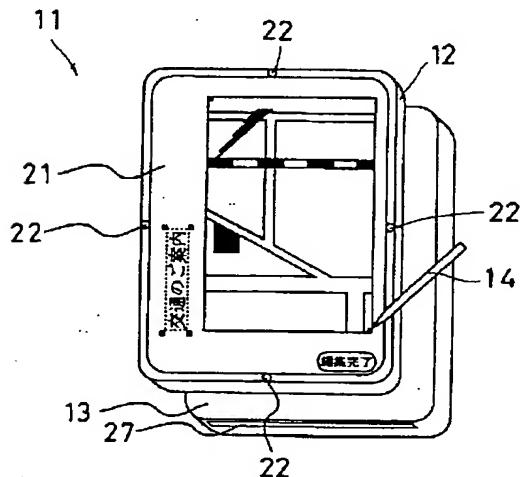
- 【図1】本発明の第1実施形態である表示装置11を示す斜視図である。
- 【図2】表示装置11を示す断面図である。
- 【図3】図2の表示パネル12を示す斜視図である。
- 【図4】表示パネル12を示す平面図である。
- 【図5】エリアセンサ38aの電気的な接続構造を示す回路図である。
- 【図6】表示装置11の電気的な構成を示すブロック図である。
- 【図7】表示装置11による処理を段階的に示すフローチャートである。
- 【図8】読み取時の表示パネル12を示す断面図である。
- 【図9】印刷時のプリンタ部13を示す断面図である。
- 【図10】本発明の第2実施形態である表示装置の表示パネル70を示す斜視図である。
- 【図11】読み取時の表示パネル70を示す断面図である。
- 【図12】ロール紙50を使用した表示装置を示す断面図である。

## \*【符号の説明】

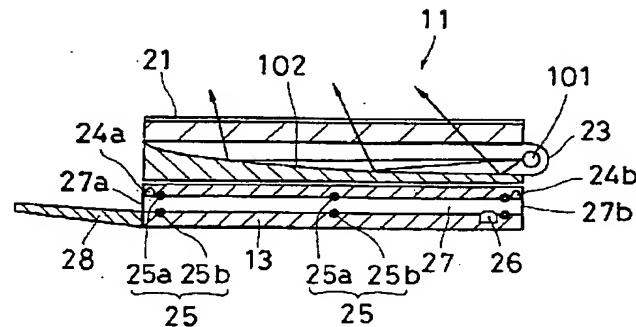
- |                |            |
|----------------|------------|
| 11             | 表示装置       |
| 12, 70         | 表示パネル      |
| 13             | プリンタ部      |
| 21             | 表示面        |
| 31, 32, 71, 72 | ガラス基板      |
| 33             | 液晶層        |
| 34             | 画素電極       |
| 35, 39         | 信号線        |
| 36             | スイッチング素子   |
| 37             | 平面電極       |
| 38             | 受光素子       |
| 38a            | エリアセンサ     |
| 51             | C P U      |
| 54             | 画像メモリ      |
| 56             | エリアセンサ駆動回路 |
| 57             | L C D 駆動回路 |
| 73             | E L 発光層    |
| 74, 75         | 絶縁層        |

\* 74, 75 絶縁層

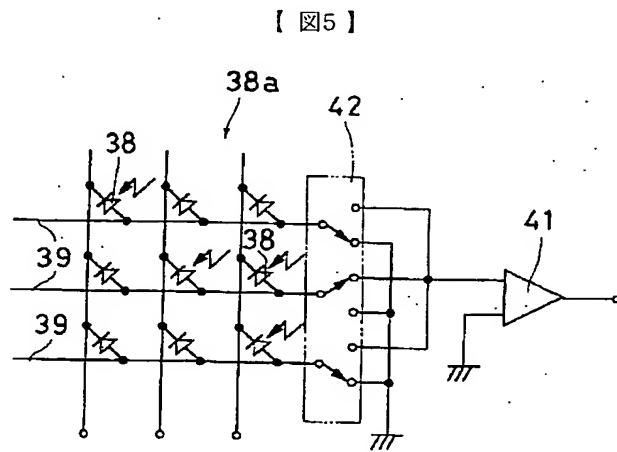
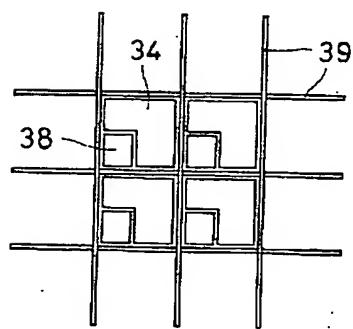
【図1】



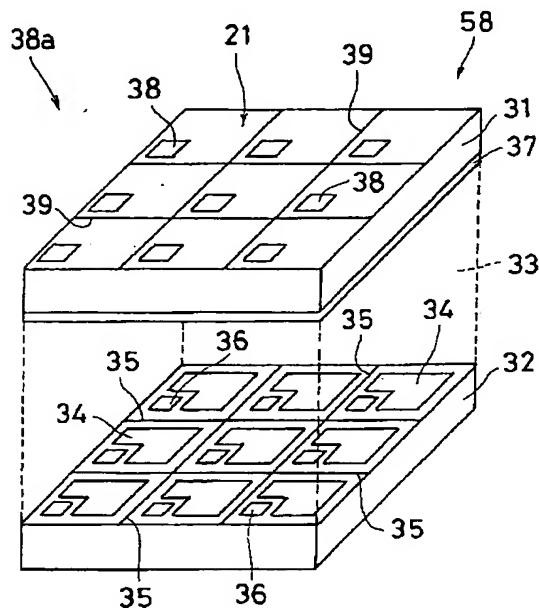
【図2】



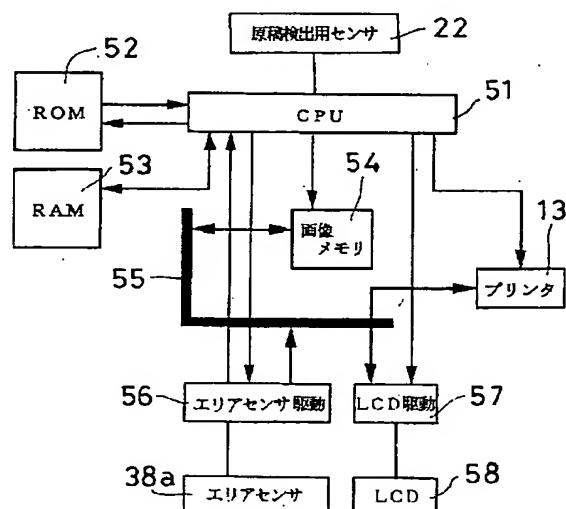
【図4】



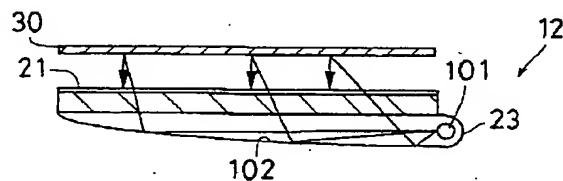
【図3】



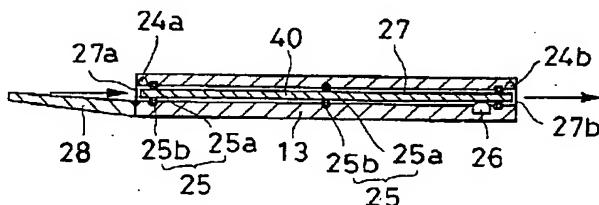
【図6】



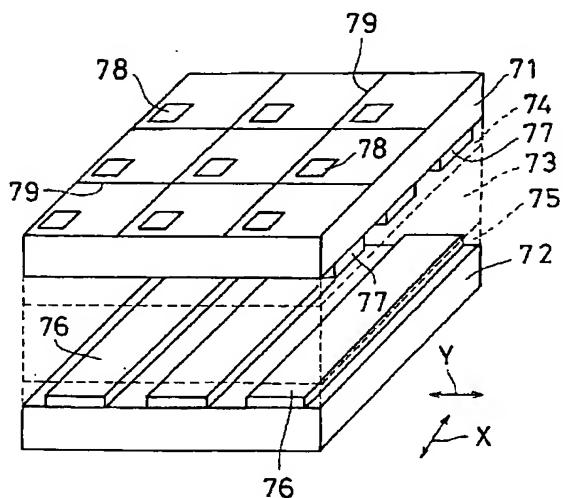
【図8】



【図9】



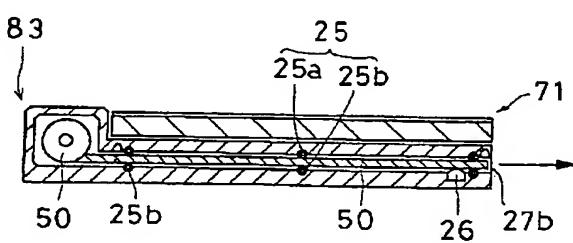
【図10】



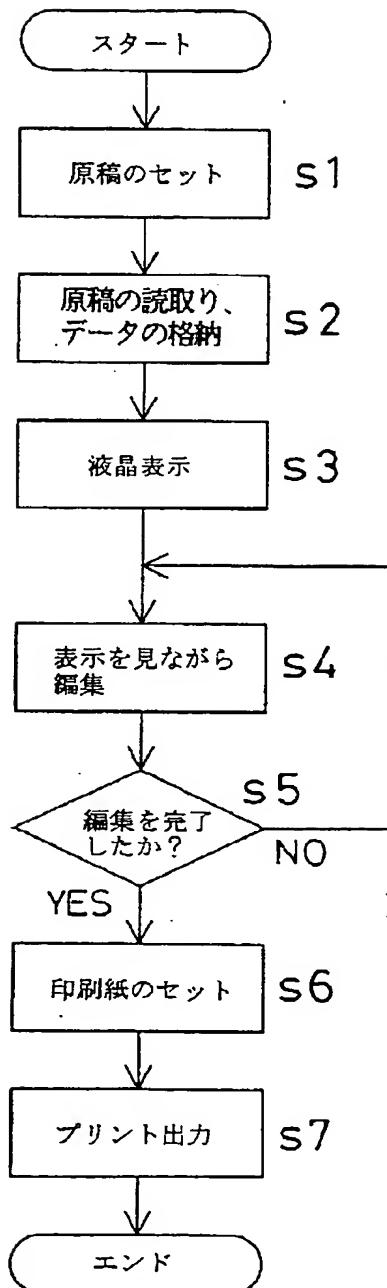
【図11】



【図12】



【図7】



フロントページの続き